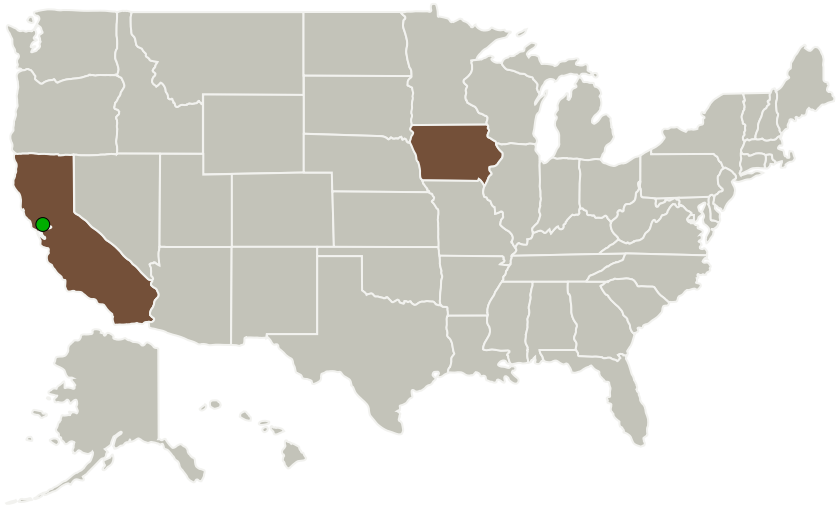
A Computational Tool for High Advance Ratio Configurations, Phase I

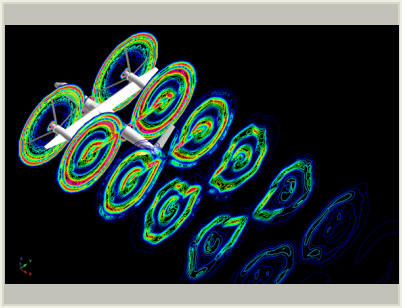
Completed Technology Project (2014 - 2014)

Project Introduction

Newer vertical lift configurations consider speed as an important design parameter with forward speeds upwards of 230 Knots, which is well above the acceptable incompressible flow regime. In such high speed vertical lift configurations, even though the aircraft may be cruising at compressible Mach numbers, incompressible flow pockets can occur in the wake of the fuselage. Hence, in contrast to most helicopters currently in use, these configurations need to be analyzed across a wide range of speed regimes including incompressible, compressible and mixed regimes. The present proposal offers to extend the design tool ``RotCFD'' to viscous all-speeds with mixed incompressible and compressible regions. In general, the algorithms used in CFD are designed for incompressible flow or compressible flow, depending upon the primary usage. RotCFD, being an Integrated Design Environment (IDE) for rotors, can be developed to seamlessly work in both regimes without additional input besides the operating speed from the design community. Additionally, this proposal offers to extend RotCFD to include grid generation with bodies in relative motion, such as tilting nacelles and wing tips, which happens in transitioning flight. The proposed extension of RotCFD for all-speed regimes and flows with mixed regimes, if proven successful, will offer the vertical flight scientific community a moderate fidelity, robust and efficient design tool. With the added potential to simulate relative motion of components, the tool will provide an analysis capability for all operational regimes: hover, conversion and cruise.

Primary U.S. Work Locations and Key Partners





A Computational Tool for High Advance Ratio Configurations Project Image

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Organizations Performing Work	Role	Type	Location
Sukra Helitek Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Ames, Iowa
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Iowa

Project Transitions

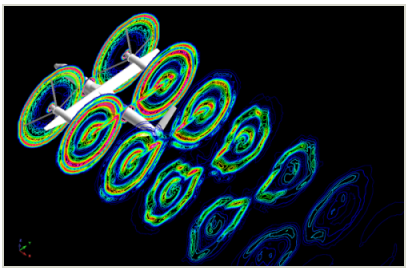
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137582)*

Images



Project Image
A Computational Tool for High Advance Ratio Configurations Project Image
(https://techport.nasa.gov/image/134501)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Sukra Helitek Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

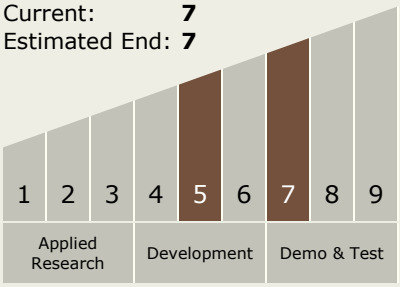
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
R Ganesh Rajagopalan

Technology Maturity (TRL)

Start: **5**
Current: **7**
Estimated End: **7**



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Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.1 Software Development, Engineering, and Integrity
    - TX11.1.3 Test and Evaluation

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System